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Florida's Frost Problem

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Synopsis—Frost has long been a serious factor in Florida's agriculture, causing at times damage to crops and groves running into many millions of dollars. It was not until the bad freeze of December 1934, however, that producers and shippers in the State became sufficiently aroused to cause the pollitical pressure that resulted in the establishment of the Federal-State Horticultural Protection Service, which operates co-operatively under both Federal and Florida State appropriations. This service was established primarily to study frost conditions in Florida and to assist in putting frost protection measures on an efficient, scientific basis; also to provide the special type of frost warnings necessary for successful frost fighting. This service was organized during the summer of 1935 and placed in operation during the winter 1935-1936. Being entirely new, the service has had to start at the very beginning to accumulate much needed temperature data. In this paper the aims of the organization are briefly told and the plans of operation outlined. Some results of the first year's work are presented.

Contrary to general public belief frosts are not at all uncommon in peninsular Florida. Serious frosts of the freeze type do not occur every year, nor even every few years, yet their visitations are frequent enough so that they hardly fall into the class of unusual phenomona. Five such freezes have occurred during the lifetime of a man now 42 years old, while the real old timers in Florida can remember many more that do not appear in the official records. Ordinarily frosts which cause considerable damage to tender truck and sometimes affect hardy truck and citrus in limited acreages in the colder places occur frequently during the average winter season. Seldom does a year pass without the occurrence of damaging frost at some point in the main citrus and trucking belts of central and southern Florida. Most of these frosts are experienced during the interval from the middle of December to the middle of February in central Florida, although early and late frosts are not uncommon. Many of these ordinary frosts, although harmful to truck, are improving the flavor, quality and color of the fruit. When the temperature falls below the critical or freezing point of citrus fruits, however, fruit damage is caused in varying degree depending on the number of hours the temperature remains at dangerous levels. When the fruit has been severely injured the temperature usually has been low enough to cause damage to the tree itself.

During the 1935-36 winter season just past the first killing frost of the season occurred late in November and the last on February 12th. During this interval there were 25 nights on which frost was experienced at some place in central Florida where official temperature stations were maintained. The lowest temperature registered at any of the official stations this season was 20.5° on December 28, 1935 and there were several occasions when the temperature dropped lower than 24° at official stations. There was extensive damage to truck and a slight amount of citrus fruit damage as well as a slight amount of damage to succulent growth on citrus trees in the coldest places. There is nothing unusual to mark this past winter in the weather records and certainly nothing unusual in the general statement that frost is a frequent visitor in the central fruit and truck belts of the State.

Severe freezes are experienced at long intervals, probably about ten years on the average. Usually lasting only two days at a time, these freezes cause damage to citrus and

truck running into millions of dollars. The effect of these hard freezes is carried over into following years resulting in greatly decreased production due to severe tree injury. Sometimes, of course, the trees are killed outright in hundreds of acres and the growers have no other recourse execpt to plant new trees if they are to stay in the citrus business.

Major freezes in the past have exerted considerable economic influence on the citrus industry. Many hundreds of millions of dollars in losses have been sustained by Florida growers and shippers. Those of you who have lived in the State for many years have seen the citrus industry driven from the fertile regions in the northern part of the State further to the southward where temperature conditions are not so severe. They are not yet safe from attack even though the conditions are more favorable, as shown by the 1934 freeze. Freezes have occurred in the past and will occur again in future. This possibility always must be faced.

The events that follow the freezes always seems to run in the same cycle and it might be worth our while to examine this cycle. I will not bore you with statistics though they could be given by the pageful. As soon as it becomes apparent there has been considerable frost damage to citrus there is much activity among the growers and shippers. Fruit is picked and rushed to the market as rapidly as possible in order to dispose of as drying out occurs. This flooding of great a quantity as possible before the market with frost damaged fruit depresses the price so that scanty returns are obtained, in many cases not sufficient to pay the freight costs. The consumers, of course, receive very little for their money and the reputation of Florida fruit receives a severe setback and the market for Florida fruit suffers almost irreparable damage. When no more inferior fruit can be shipped the growers appraise their damage. Their frost losses are not only from the total destruction of a part or all of the crop but also from the killing of fruit bearing wood as well. Young trees have been killed outright or injured to such extent they are practically worthless. On mature trees it is evident that production will be quite seriously affected for some time to come.

The sudden loss of a large crop ready for the market has affected the operation of the agencies engaged in packing, shipping, and marketing the fruit. Contracts for packing material and services concerned with moving the crop to market are cancelled resulting again in widespread losses, especially to the railroads.

Other indirect losses follow in rapid succession. Many citrus properties revert to mortgage holders. Among the more fortunate still able to hold on are many whose reduction in working capital as a result of the freeze is such that their groves suffer further deteoriation by neglect in fertilizing, pruning, pest control, and other farm operations. In fact, in some sections orchard values decline because of widespread neglect. Community payrolls suffer by reason of unemployment of citrus workers and the loss of purchasing power carries the freeze damage into the ranks of business and professional men not otherwise connected with citrus production.

Economists tell us that if the market developed for Florida fruit is to be held against competition from fruit produced in other parts of the country the Florida citrus industry must be prepared at all times to suppy the market with the required quantity of good quality fruit. This factor becomes of more importance if, as is now being done, vast sums in national advertising are expended to develop special markets. In view of recent organization since the 1934 freeze it is extremely doubtful if growers will be permitted to ship frozen fruit in future. Florida must now provide some means of being able to supply this newly developed market with a steady flow of fine fruit irrespective of weather conditions. California has done this; so, too, can Florida. Effective grove heating is the answer.

The bright spot in this program of grove heating is that the costs will be by no means as high as in California. The average grove needing frost protection in California burns heaters about 29 hours a year on a ten year average. In Florida I doubt if the corresponding figure would exceed 5 hours. The greatest expense here would be in depreciation and in the setting out and taking in of the heaters an operation that must be done each season so that the heaters will be in place when needed. There are certain economic laws that determine the feasibility of adding to the production costs the overhead expense of heating. The essential factors are the overhead and operating costs and the probable savings that will result. Operating costs can be estimated with a fair degree of accuracy if the average number of hours of heating per season is known. The probable savings are more difficult to figure since they bear on the production per acre and the price received for the fruit.

By effective grove heating I do not mean that every citrus property in Florida should be provided with heaters, but that a sufficient producing acreage should be equipped so that the market will not suffer during freeze years. There are undoubtedly some citrus properties in Florida where severe frost damage, even during the freezes, occurs so seldom that the savings to the grower brought about by the use of heaters would not, in the long run, equal the cost of grove heater operation. There are also probably many marginal citrus properties in Florida where the average annual return is so small that the expense of heating could not be borne. At the same time there are probably many groves so situated that the capital invested in grove heating work would pay handsome dividends on the investment. My present impression is that about 25% of Florida citrus properties profitably could be equipped with some form of adequate frost protection.

There are no half way measures with grove heating. Either it must be done right or not at all, else the costs of heating be added to other frost losses. In my examination of the State I am sorry to say that I have found many hundreds of acres equipped with insufficient equipment for good frost protection work. It is small wonder that many growers feel that grove heating is a snare and delusion for that is exactly what it is in many Florida groves at present.

The weather conditions under which these major freezes occur are well known to meteorologists, as each time events happen in much the same sequence. The initial stage of a Florida freeze is the formation of a huge mass of extremely cold air over the polar regions of northern Alaska and Canada. This condition is almost always accompanied by high barometer. Therefore the appearance during winter of a strong high pressure area in western Canada accompanied by abnormally low temperatures is a potential threat of severe frost shortly later in central Florida.

These polar air masses drift at varying speeds across the country in erratic paths from west to east and sometimes in their passage do not sweep far enough to the southward to affect Florida. Although each polar air mass carries a potential threat of frost damage for Florida, the per-

centage that actually reach into central Florida is not large. Last winter eight polar cold waves threatened Florida, that is, actually passed far enough southward to strike into Alabama and Georgia, but not one actually reached into central Florida to cause general severe temperature conditions. It is only when an energetic low pressure area forms or passes over the Gulf of Mexico and follows a path northward or northeastward over the Atlantic Coast States on the forward, or advancing side of a strong polar air mass, that the cold air flows into the peninsula bringing low temperatures to central and southern Florida. Even then a major freeze is not so apt to occur if the wind continues to blow with sufficient force to keep the surface air well stirred, thus preventing a large fall in temperature during the night. The most serious freezes occur when the wind dies out after large quantities of excessively cold and abnormally dry air have been brought over the peninsula. Under these conditions the temperature which has remained low all during the day falls with alarming rapidity after sundown, reaches damagingly low levels early in the night and stays there for many hours. As there is no great diversity in topography in central and southern Florida these freezes are likely to be quite general and cause severe losses in all sections of the State. Such freezes ordinarily last two days at a time, with the second night colder than the first, and although they happen on the average only after lapses of several years cases have been known to occur where two hard freezes occurred during the same winter season, spaced about a month apart.

Although the conditions that occasion the great freezes are known and understood the actual forecasting of their arrival is a more difficult matter since many different weather elements have to be estimated correctly before the minimum temperature can be determined. An error, even a slight one, in estimating the humidity, direction and force of the wind, cloudiness, or pressure gradients may cause an error of several degrees in the forecast of minimum temperature.

Prior to the winter of 1935 a specialized frost protection service had never been in operation in Florida During these years frost warnings for the citrus and truck areas in Florida had been handled as a part of the general weather service by the District Forecaster located at the Forecast District Center at Washington, D. C. In order fully to understand the situation that existed in Florida prior to the winter of 1935 it may be well to review briefly the organization of the Weather Bureau as regards the general forecasting service. The entire United States was divided into five large areas known as forecast districts, each district comprising many States. At each forecast district center an official designated as the District Forecaster is charged with the responsibility of making all weather forecasts and issuing all weather warnings within the confines of his own district. That is to say, all the weather forecasts issued for the entire United States were prepared by five men, one in each forecast district. As might be expected, these men are selected with great care after many years of experience in practice work and are given for their work the utmost in facilities the Weather Bureau can command.

At each Forecast District Center comprehensive weather charts are prepared at least twice each day based on wire reports from a large number of stations spread in a network over the United States, Canada, Mexico, and from ships at sea. Upper air observations by pilot balloons and airplanes are at the forecasters disposal. From the weather maps prepared from these numerous data the daily forecasts are made.

Under the scheme of organization just outlined the forecasts for the State of Florida were prepared by the District Forecaster in Washington based upon the general weather map and verified by reports from the several first and second order Weather Bureau stations in Florida whose wire reports were used in the construction of the forecaster's weather map. These Florida reporting stations are Pensacola, Apalachicola, Jacksonville, Titusville, Tampa, Fort Myers, Miami, and Key West. It is evident that all of these stations are located upon or near the immediate coast. Also the thermometers at each of these stations, as is quite customary, mostly were located on the tops of tall buildings in the business sections of these larger cities. Thus the District Forecaster was largely guided in his temperature forecasts by the reports of temperature at elevated city locations in coastal cities. The forecasts so issued showed a high percentage of verification.

Temperature conditions in the various portions of the citrus and truck belts of Florida, however, can be de-

termined only by accurate thermometers located in the groves and truck gardens at strategic points in the different portions of the district. Except by so doing there is no way that the lay of temperatures accurately can be determined. Readings from thermometers exposed at elevated stations on tops of tall buildings in the business districts of large cities are virtually useless for such purposes, yet it is a fact that prior to the establishment of our service such records formed the very backbone of temperature survey work in Florida. Equally useless are the readings from scattered points from stations deliberately placed in the warmer parts of the local areas to provide favorable comparisons with other communities. Such stations usually are not representative of more than a few per cent of the total acreage of commercial crops in the areas they are supposed to cover. Also there are some stations maintained in or near groves by individuals with privately owned equipment from which occasional observations are taken. In many such cases the records are largely unreliable because of faulty thermometers, faulty exposures, and unsystematic observations. To gauge temperature conditions in a great agricultural area by means of a network of such stations as I have described is nothing more or less than a form of delusion, and as proper knowledge of temperature conditions in important parts of the citrus and truck belts was not to be had it is small wonder that growers and shippers expressed such continual dissatisfaction with the forecasts of the District Forecaster. Such forecasts covering worlds other than their own had no particular value to them in their actual frost protection work.

In the endeavor to supply the particular kind of forecasting service so greatly needed by Florida producers and shippers and at the same time to assist the growers in their efforts to protect their crops against damage by frost, the Horticultural Protection service was established last winter by co-operative Federal-State appropriations totalling $25,000. The service is a joint effort of the United States Department of Agriculture, Weather Bureau, and the Agricultural Experiment Stations of the University of Florida.

Generally regarded as the most important of the various projects of the Horticultural Protection Service at present is that of the temperaure survey. This will take at least ten years to accomplishe, possibly longer although it becomes more valuable as each season's data are compiled and we do not have to wait until the full estimated ten years have elapsed before the information so collected can be put to use. So important is the temperature survey that of the five men engaged on the fruit-frost work last winter, four spent practically all their time on this part of the project.

The object of the temperature survey is to determine the lay of temperature over the district on cold nights; that is, to find out the variations in temperature in different parts of the district. Its ultimate object to the forecaster is to show him definitely the ditsribution in temperature that will exist under differing weather conditions so that after the 24-hour weather changes have been estimated in advance he can carry the forecast into the different parts of the citrus and truck belts to the extent of stating exactly the temperature conditions that will prevail at any particular station in any portion of the district. To the grower the temperature survey will provide a knowledge of the areas where it will be on the average either profitable or unprofitable to grow certain crops because of temperature conditions. If he needs frost protection the temperature survey will show him this fact and provide the means of calculating the expense of operating grove heaters, which, in turn, enables him to determine whether the addition of grove heating costs to his other production costs will pay him dividends. To the marketing agencies the temperature survey will provide the necessary information to form a rough but fairly accurate estimate of the amount of damage to be expected following a spell of damaging temperatures. Suppose, for example, it was desired to know the extent of damage to citrus following a freeze. If the temperature that causes damage to citrus is known, and such temperatures can be determined, then the amount of damage that will result is directly related to the number of acres of citrus in the areas where the temperature was below this critical point for the required time. The California Fruit Grower's Exchange have calculated formulas to estimate within a few hours after the temperature survey records are available, damage to citrus based on this simple principle and the results have been so closely verified by the grove to grove checking of field men that this formula

now is used to regulate the administration of the Exchange in the selling and advertising fields almost as soon as the frost occurs. The temperature survey will make possible such damage estimates for Florida marketing agencies. So from the standpoint of the individual growers and shippers there is much to be gained from an accurate temperature survey which will show temperature conditions in their own local areas.

To accomplish the temperature survey a comprehensive network of temperature stations was established last winter in as large an area in central Florida as our available funds would permit us to cover. These stations were placed in the various agricultural sections in farm exposures; citrus stations were elevated to a point 4½ feet above the ground, truck stations were located about one foot from the ground. Except for a few stations especially placed in extremely warm and cold spots, all stations were located so as to be representative of considerable near-by acreage with the average station covering the temperature conditions over about 30% of the groves in the vicinage, this 30% being in the colder sections. Although the temperature survey has been planned to lean toward the colder side, provision has been made to include the higher ground acreage by the addition of temperature inversion experimental work. A steel tower 125 feet high was erected at the Lake Alfred Citrus Experiment Station by Dr. A. F. Camp, and at spaced intervals on this tower temperature records were obtained from the ground up to the 112 foot level. Another series of temperature inversion stations were maintained between Waverly, Highland Park and the Bok Tower near Lake Wales. The purpose of these experiments was to determine the degree of warmth afforded by elevation on cold nights and the modification to be applied to survey station readings to represent high ground conditions.

Each temperature station was equipped with a properly designed fruit-region thermometer shelter in which were exposed accurate recording thermometers. About 120 stations were so established last winter and in addition to the thermometers about half of the stations were equipped with automatic clock thermometers so that continuous records of temperature were traced on a ruled sheet of paper. The Thermograms so obtained provided us with the duration of each degree of temperature at selected stations. At a few stations automatic records of relative humidity were obtained by the use of an instrument technically called a hygrograph. Each shelter has a wire screen front which faces toward the north so that the instruments within are visible at all times to all comers. The public is invited to make use of the stations at all hours of the day or night in connection with their frost protection work and several thousand dollars worth of high grade equipment was available for public use. Most of the stations were placed in the hands of co-operative observers who were instructed in the care and reading of the instruments. Each station was visited at frequent intervals by a staff member of the Horticultural Protection Service, to insure the accuracy of the temperature readings and the continuity of the records. The States owes a debt of gratitude to this large army of voluntary observers who by their excellent co-operation assisted so materially in the prosecution of temperature survey work.

From the stations of the temperature survey network about 40 were selected to serve as forecast stations in the central Florida area. In most cases the colder stations representative of about 30% of the local acreage were chosen. Definite minimum temperature forecasts were issued for each of these stations when the temperature was expected to drop to 32° or lower. Thus the forecasts were issued for the coldest temperatures to be expected close to the ground in the colder part of the area served by the forecast stations. Most of the acreage in the immediate vicinity, of course, was expected to have higher temperature than the forecast station. This temperature difference between high and low

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CITRUS GROWERS' OPPORTUNITY

Florida citrus growers this year have an opportunity to make a reputation for Florida citrus fruits, to establish a record for unity of action and make money for themselves — if they will handle the marketing situation inteligently and harmoniously.

The present outlook is that the citrus crop of Florida this year will be of superior quality. This supplies the foundation upon which the reputation of Florida citrus fruits may be built. We have this year a maturity law, which if strictly enforced, will prevent the shipment of unripe fruit, which in past seasons has operated to cast reflection upon the quality of our fruit. With the promise of a crop of superior quality and the strict enforcement of maturity standards, Florida growers should stand to profit from the sale of this season's crop.

But, along with the promise of a crop of exceptional quality, there is also the outlook for for an abundant yield, far in excess of that last year — and therein lies an element of danger. With an abundant crop, there will exist the same old temptation to evade maturity standards and to rush unripe fruit to market in the hope that early shipments may yield a profit to growers and shippers regardless of its effect upon the future market.

Commissioner Mayo and his inspectors may be counted upon to exert every precaution to prevent the shipment of any fruit not passing the maturity tests. In this effort they will have the backing and the co-operation of the Florida Citrus Commission — and they should have the support and co-operation of every grower and shipper in the state, for in this way only can the citrus industry of Florida hope to profit as a whole, or its individual members hope to profit from the sale of their superior quality fruit.

With the maturity and grade standards now in effect backed by an alert body of inspectors, with the Citrus Commission functioning for the protection of the markets and allocation and diversion of shipments, Florida citrus growers stand to reap a profit from the anticipated crop of superior excellence far in excess of their returns in recent years. But, to accomplish this, growers and shippers must present a united front behind the inspection service and the Citrus Commission. Each individual grower and shipper must make it a part of his business to see that no unripe or inferior fruit finds its way to market, regardless of any temptation to reap a present profit at the expense of future markets.

ASK UNCLE SAM TO BUY SURPLUS CITRUS

Florida's United States Senators, Hill and Loftin, joined by Senators Sheppard and Connally of Texas, have addressed a letter to President Roosevelt urging that a fund of several million dollars be allocated from the appropriation of the agricultural adjustment administration for the purchase of surplus stocks of citrus fruits for distribution among needy families in the western drouth regions.

Anticipating a much larger crop of citrus fruits than last season, the senators from Florida and Texas have urged the purchase of some share by the government agencies. It is pointed out that in spite of largely increased production, the farm value of Florida's citrus crop has dwindled from $51,000,000 for the five-year period ending in 1930, to $37,000,000 for the past four-year average.

Senator Hill said that he would insist that fruit bought by the government for distribution to the nation's needy be of high grade and of maturity standard high enough to meet the state's requirements. The senators joining in the request to the president believe that the fruit should be purchased through direct negotiations between growers and representatives of the agricultural department.

The Florida and Texas senators joining in the proposal believe that such action on the part of government agencies would tend to care for the anticipated surplus from this season's crop, that it would have a tendency to stabilize prices and solve at least a portion of the growers' marketing problems, while at the same time providing food of pre-eminent desirability to thousands of families who because of the devastating effects of the drouth would not be in position to purchase.

With the largely increased crop anticipated in all of the citrus producing states in the Union, it would seem that some such action by the federal government would be advisable, not only from the standpoint of the citrus growers, but also from that of the many needy and destitute families in the drouth stricken regions of the mid-west. Florida and Texas citrus growers will watch the outcome of their senators' proposal with interest.

It will soon be time to make that fall application of fertilizer. A grove neglected now will neglect you next season.

Some Field Tests With Magnesium Sources ...

W. L. Tait
DeLand

The yellowing of foliage of citrus trees in the later summer and fall has been observed for several years. This loss of green color is generally first noted and develops to a greater degree in the seedy varieties of grapefruit. Later in the season it becomes apparent in Pineapples and Valencias. While Marsh Seedless grapefruit do not escape the yellowing, they are not often as seriously affected as the other varieties. Tangerines also sometimes show the chlorotic condition more or less.

The type of chlorosis, or loss of green color, which has been referred to, is very easily distinguished when once its characteristics have been fixed by the mind's eye. First of all it appears in the older leaves—it has never been observed in leaves of the most recent growth flush. The pattern is distinct—a row of light green or yellow spots on each side of the midrib, which gradually merge to form a yellow stripe and finally the entire leaf becomes pale green or yellow. Several names such as "bronzing", "yellow leaf", "copper leaf" will be used since it most accurately describes the color of the affected leaves. Indications are that "yellow leaf" in citrus is due to a deficiency of magnesium.

Bryan and DeBusk (2) recently reported the prevention of "bronzing" of citrus by the use of dolomitic limestone. The use of the term "bronzing" for the above described symptoms of citrus associates it to some extent with the abnormal condition of tung trees called "bronzing" which is corrected by the application of zinc sulfate. The use of zinc sulfate on citrus trees affected with "yellow leaf" has not corrected the condition—at least that was the observation in a limited number of cases in the summers of 1934 and 1935. The yellowed leaves soon dropped after the application of the zinc sprays, leaving the trees much thinner in foliage.

Very often "yellow leaf" is severe on those trees bearing a heavy crop of fruit, the foliage becomes thin by fall and the trees being in a rundown condition put out but little spring growth and set no fruit. In periods of unfavorable weather, drouth or cold, such trees are unable to withstand the hardships and die, or have a long struggle to survive.

As has been stated, the period of the year when the yellow foliage is most noticeable is from July through December. Many of the old affected leaves drop during the winter months and after the spring flush there is rarely any indication of the condition.

In general, the sections or areas where the trees are most usually affected leaves drop during the winter months and after the spring flush there is rarely any indication of the condition.

In general, the sections or areas where the trees are most usually affected with "yellow leaf" are the high lying sandier soils in the central part of the State, while the condition is less prevalent in hammock groves in the interior and rarely seen in groves along the East and West Coasts on soils overlying marl.

Tests With Various Forms of Lime

In June 1932 some citrus fertilizer experiments were begun at Davenport which included a study of the effects of several forms of liming materials. These materials and their rates of application are shown in the table at top of page twelve.

* Formerly located at Davenport, Florida, with the Holly Hill Grove and Fruit Co. and Wilson and Toomer Fertilizer Co.

The acre applications were slightly more than shown above as the materials were not broadcast over the entire soil area but were applied evenly in broad bands about the trees. The regular fertilizers were high-grade mixtures usually deriving forty per cent of the nitrogen from organic sources and each application was uniform for all plots.

The monthly rainfall records at the Davenport Station operated in cooperation with the United States

Weather Bureau for 1932 to 1935 inclusive are shown below.

Material	Summer Application. Lb. per tree	Fall Application. Lb. per tree	Approx. Application per acre per year (lbs.)
Hardwood Ashes	30	15	2250
Finely Ground Oyster Shells	20	10	1550
Hydrated Lime plus Manganese Sulfate	20	10	1550
Dolomitic Limestone	20	10	1550
Finely Ground Oyster Shells plus Epsom Salt	20 2	10 1	1550 150
Epsom Salt	2¼	1⅛	168
Kal-Cite	15	8	1150

INCHES RAINFALL.

Month	1932	1933	1934	1935
January	.61	.94	.41	.97
February	.27	2.61	3.01	1.51
March	3.50	2.13	5.84	.30
April	.74	3.07	5.61	1.56
May	4.98	1.68	5.68	3.51
June	7.47	7.19	19.91	5.13
July	3.87	15.74	7.64	7.14
August	13.01	6.52	5.20	3.96
September	2.79	19.25	3.95	8.74
October	1.15	1.92	.89	.76
November	2.72	1.06	.22	1.77
December	T	.36	.79	3.49
Total for Year	41.11	62.37	59.15	38.84
Departure from Normal	Minus 10.23	Plus 11.03	Plus 7.46	Minus 12.85

RESULTS

It was not until the summer and fall of 1934 that marked differences showed between the treated and check plots. So far as "yellow leaf" was concerned, there was not a great deal of difference in the check plots and those receiving ground oyster shells or the hydrated lime-manganese mixture. There was only a small amount of yellow leaf in the hardwood ash and Kal-Cite plots but in the plots receiving dolomitic limestone, Eposom Salt, or ground oyster shells plus Epsom Salt, all leaves maintained a healthy green color throughout the fall season.

Yield records do not cover a period long enough to give much important data at this time but it is reasonable to believe that a treatment which maintains the general vigor of the trees will result in increased yields. Ruprecht (3) states that the plots at Lake Alfred receiving low-grade sulfate of potash-magnesia continue to show a larger yield and a more rapid growth than those receiving potash from other sources used in the Sources of Potash Test. He also found the same to be true for Pineapples on the East Coast several years ago. Cover crop growth has varied from year to year but in general has been greater where the liming materials have been applied.

The effects of the various materials upon soil reaction as determined by the quinhydrone electrode are shown in the table on next page.

Soil samples were drawn in a number of places in each plot from the upper 6 inches, 7 to 12 inch depth, and at the 18 to 24 inch depth. The data shows the average pH expressed in moles per liter of the upper 6 inch samples from each plot.

Rapid chemical tests were made for Calcium and Magnesium on the samples taken in August 1935 and March 1936. The plots receiving dolomitic limestone showed the largest amount of available magnesium with the Epsom Salt and hardwood ash plots following closely. The oyster shell plot had the least magnesium of the treated plots, and the check plots had hardly more than a trace. The dolomitic limestone plot showed somewhat less available calcium than the other treated plots.

Soluble Magnesium Materials Used In 1935

Since both forms of magnesium gave promising results, trials of the soluble materials were installed in early July 1935 in order to determine if they would prevent "yellow leaf" in a single season or correct it after the condition had appeared in the foliage. Materials containing potash alone or in combination with mag-

nesium were used to determine, if possible, the role of potash in this connection, also hydrated lime and mineral and organic sources of nitrogen were included.

The materials and the rates at which they were applied to large grapefruit trees were as follows:

	Materials	Lb. per Tree
1	Emjeo	1.35
2	Sulfate of Potash-Magnesia	5.00
3	(Sulfate of Potash	2.70
	(Emjeo	1.35
4	Sulfate of Potash	2.70
5	Kainit (14% K2O)	9.00
6	Emjeo	3.00
8	Hydrated Lime	10.00
7	(Emjeo	3.00
	(Hydrated Lime	10.00
8	Hydrated Lime	10.00
9	Castor Pomace	6.00
10	Sulfate of Ammonia	1.30
11	(Emjeo	3.00
	(Sulfate of Ammonia	1.30
	(Emjeo	3.00
12	(Castor Pomace	6.00

Observations were made throughout the summer and fall but no changes could be detected in the color or growth of the foliage on the treated plots in comparison with the checks, nor is it possible to see any differences in the trees this spring.

Spray Tests in 1935

As zinc sulfate applied in sprays to citrus trees has given satisfactory and prompt control of frenching, experiments were installed on May 20, 1935, to determine what effect magnesium sulfate would have upon preventing or correcting "yellow leaf". The materials used per 100 gallons of water are listed below.

Plot	Lime Sulfur Solution gal.	Enduro Spray Sulfur lb.	Emjeo lb.	Per cent of squares infested with Rust Mites 5-16-35	7-5-35	9-24-35
1	2	6	2	37	61	28
2	2	6	8	52	64	44
3	2	6	0	35	51	24
4	2	6	4	43	61	27

(Second spray applied July 6, 1935 with lime sulfur solution at 1to 80 dilution but other materials as above.)

By late fall it was not possible to see any marked differences in the foliage of the sprayed and unsprayed plots. Perhaps larger quantities of Emjeo might have had some effect, but a commercial response was not noted with the amounts used.

In connection with this test, data on the effect of adding Emjeo to lime sulfur sprays upon rust mite control were obtained for the season. The percent of squares infested with rust mites for each plot is shown in the above table. In this case the July counts showed that the infestation of mites was considerably greater on the Emjeo plots, where as the September counts showed only the 8 pound Emjeo plot to have a significantly higher infestation.

DATES OF DRAWING SOIL SAMPLES

	8-29-32 pH	2-20-33 pH	8-23-33 pH	8-10-34 pH	9-15-34 pH	1-10-35 pH	8-1-35 pH	1-3 36 pH
Check	5.24	4.89	5.27	5.24	4.80	4.85	5.08	5.30
Hardwood Ashes	6.29	6.24	6.70	7.18	6.46	5.66	6.07	6.57
Finely Ground Oyster Shells	5.49	5.38	6.77	7.02	5.80	5.85	6.25	7.04
Hydrated Lime— Manganese Sulfate	5.80	7.12	7.03	6.85	6.01	6.96	6.49	7.53
Dolomitic Limestone	5.52	5.03	6.07	6.51	5.48	5.77	5.62	6.43
F. G. Oyster Shells plus Epsom Salt	6.11	5.52	6.51	6.96	5.70	6.15	5.96	6.72
Kal-Cite	5.58	5.36	6.58	7.00	5.85	6.07	6.14	7.11
Epsom Salt	5.28	4.96	5.15	5.18	4.85	5.02	5.05	5.75
Check	5.23	4.75	4.96	5.21	4.92	4.92	4.96	5.67

The trials with the soluble magnesium sources applied to the soil and in sprays were for one season only and further tests under different seasonal conditions may bring about somewhat different results.

The apparent lack of response of citrus trees to magnesium sprays is not greatly surprising in the light of results secured by Chucka of the Maine Experiment Station. Working with potatoes, he found that magnesium sprays did not enable yellowed leaves to regain their green color but no more chlorosis developed after the application of the magnesium and all of the new growth had a healthy green appearance. However, in New Jersey, it has been reported that chlorotic spinach sprayed with magnesium sulfate regained its color and was ready for shipment in one week after treatment.

Discussion

It has long been known that magnesium is an essential element for plant growth. Chlorophyl is made up of ozygen, hydrogen, carbon, nitrogen, and magnesium. In addition to being a component part of the green coloring matter of plants, Bernardini (1) considers magnesium to be active in the assimilation of phosphoric acid and in the transportation of phosphorus to growing and maturing seeds, and to young shoots.

Magnesium deficiency has been noted in tobacco for many years and is commonly called "sand drown". More recently magnesium deficiency has been observed in potatoes, corn, cotton, cabbage, spinach, and other crops in many states along the Atlantic Seaboard.

Magnesium deficiencies are likely to be more severe in seasons of excessive rainfall, especially on acid soils low in organic matter. Large quantities of sulfates in the fertilizers tend to increase magnesium leaching from the soil—the principal ones being sulfate of ammonia, sulfate of potash, and calcium sulfate. Willis of the North Carolina Experiment Station has found that the application of high calcium limestone decreases magnesium leaching.

Up to the present, there have been few cases of magnesium deficiency reported in Florida. Perhaps this is due to failure to recognize the symptoms or to the fact that magnesium is carried in small quantities in organic nitrogen and potash materials. Several of our soils are well supplied with magnesium, notably the mucks, the glades of the lower East Coast, and soils overlying marl in the interior and coastal sections.

The indications are that a supply of magnesium should be taken into consideration as well as nitrogen, phosphorus, potassium, and calcium. In fact, recent work by Garner and his co-workers shows the necessity of including not only calcium and magnesium for tobacco but also proper amounts of sulfur, chlorine, and boron.

Observations on these tests indi-

cate that striking responses by citrus are not seen until about two years after the application of magnesium bearing materials. However, since magnesium deficiency symptoms are more clearly understood it may be possible to detect the response in less time in the future.

Conclusions

At the present time, the problem of supplying magnesium to Florida citrus and truck crops does not appear to be a difficult one because of the variety of the sources of the element. These sources may be roughly divided into two groups. The slowly soluble magnesium carriers such as dolomitic limestone and hardwood ashes, also there are appreciable amounts in organic nitrogenous fertilizers—bird guano, stable manure, cotton seed meal, and Milorganite. Quickly available magnesium is contained in Emjee, Epsom Salt, sulfate of potash-magnesia, and kainit.

The grower may choose from this list the material that best fits his particular needs, bearing in mind that the chances for loss by leaching are much less when the more slowly soluble forms are used and that the supply to the crop will likely be more uniform throughout the year. Where soils are low in both calcium and magnesium, dolomitic limestone, hardwood ashes, or Kal-Cite will give satisfactory results. Soils that have previously had applications of high calcium limestone and are low in magnesium should receive the other forms of magnesium which do not materially raise the soil pH.

Since the soluble forms of magnesium leach rapidly from the soil, these should be applied to citrus at intervals during the year either in the fertilizers or as special treatments.

The rates of application of the various materials used in these tests are not intended as recommendations to growers. In most cases they are larger than practical for a commercial scale. In general, from 500 to 1000 pounds per acre of dolomitic limestone will be sufficient every two or three years, depending upon soil type and reaction.

A wave of enthusiasm for magnesium is sweeping over Florida and a word of caution is in order at this point. Overliming of citrus in years past has produced most unfortunate results, and good judgment and care must be exercised in order to avoid a repitition of the mistakes of the past. First of all, determine in a reliable way if the soil and crop need calcium or magnesium, but do not apply them without reason.

Findings to date indicate that most soils which are low in magnesium are also low in calcium and since dolomitic limestone supplies both of these elements in forms not quickly leached by heavy rainfall, dolomite is an excellent material for our conditions. Field results show that trees to which dolomitic limestone, hardwood ashes, or Kal-Cite were applied have a more uniform green foliage, have made larger growth, and are generally more vigorous than the check trees in the same groves.

SUGAR SYRUP BANNED IN FRUIT JUICES

In a notice to packers and shippers of fruit juices, the Federal Food and Drug Administration has said definitely that the addition of water in the form of sugar syrup to products sold as fruit juices will no longer be tolerated. Beginning July 1, 1936, legal action will be taken against interstate shipments of fruit juices containing added water regardless of label statements indicating the addition of sugar syrup. The notice states there is no objection to the addition of dry sugar, providing the labeling declares its presence.

In the view of the enforcing officials, such adulteration of fruit juices is an unwarranted imposition on the public, in spite of the carefully-worded statement "sugar syrup added" appearing on all such products. Better manufacturers, too, it is believed, are opposed to the practice, which is productive of unfair competition and tends to lower the standing of the entire industry.

The text of the notice follows:

This notice applies to **fruit juices** as distinguished from **fruit syrups, fruit type beverages,** and the like. The necessity for maintaining the identity of such basic food products as fruit juices needs no elaboration.

Some manufacturers have been adding sugar in the form of sugar solutions of varying strength, labeling the product, for example, "Orange juice," with a subsidiary label statement of the added ingredient, almost invariably in smaller type and removed some distance from the name of the product. It has become apparent that the consumer who buys fruit juice does not realize the dilution with water that thereby occurs, which sometimes amounts to 25 per cent.

There appears to be no practical reason why the sweeting of fruit juices, if desired, should not be accomplished by the use of dry sugar alone; consequently the dilution of fruit juices with water, even in the form of sugar solutions, is held to be in violation of the Food and Drug act.

Conformity with the provisions of the Food and Drugs act requires that basic product names, such as "Orange juice," "Grape juice," and the like, be directly and conspicuously qualified, when dry sugar has been added. To be properly informing the labeling of such products should indicate the quantity of added sugar, for example, "Sweetened Orange Juice 2% Sugar Added."

The effective date of this notice was July 1, 1936.

CITRUS FRUIT BUDS AND SOME FACTORS INFLUENCING THEIR DIFFERENTIATION.

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rotary microtome. The sections were mounted on glass slides, stained and examined under the microscope.

In this work it was found that differentiation of blossom buds in the species of citrus studied does not take place until the beginning of growth in the spring or upon the resumption of growth at any other season of the year following a period of envioronmental conditions favorable and of sufficient duration for the accumulation of a reserve food supply. Therefore the time of differentiation will vary slightly from year to year with climatic and seasonal variations. This is evidenced by the occasional blossoming of citrus trees during the summer or early fall, when forced into growth following a prolonged dry period or after branches have been girdled for a sufficient time and later forced into growth. The prolonged check in growth during the winter months, in the absence of limiting factors seems to be especially favorable for bringing about proper conditions for abundant blossom bud differentiation during the spring, especially in the grapefruit, orange and satsuma.

The growth and fruiting habit of the Nagami kumquat differs somewhat from that of the citrus species studied, in that the majority of the fruit buds formed for the crop of the current season are differentiated during late May or early June on wood that was formed during the spring of the current season. However, a few flower buds were observed to come out on older wood which was produced the previous season, or perhaps earlier. The failure of the Nagami kumquat to differentiate and push out blossoms in great numbers at the first flush of growth in the spring of the year following the prolonged winter check in growth, is evidently due to specific and generic characteristics.

In the grapefruit and orange it was found that most blossom buds are formed toward the outer extremity of the last flush of growth on the branch, regardless of whether the

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ground may amount to as much as 20° during ordinary frosts in the case of long hillside slopes, or may amount to more during exceptional conditions that sometimes do occur. But no grove near the station on low ground will show a much lower temperature than that recorded at the forecast station for the reason that the forecast station was chosen to represent the colder grove exposures.

We offer, however, a very simple and practical means of changing the temperature forecast to fit any high ground grove in the area served by the forecast station. That is to say, any grower who so desires easily can change the minimum tmeperature forecast to make it fit stations on his own property even right down to his own back yard. All he has to do is to establish a temperature station in the desired spot, equip it with a tested thermometer of the minimum recording type in a small shelter which will screen it from the sky, and make a record of daily readings of minimum temperature. He then compares his temperature readings with those taken on the same day at the forecast station to determine the difference. Suppose, for example, that a grower in Winter Park has compared his minimum temperature readings with those of the Forest City forecast station, which serves his area, and has found that on the average the temperature at his station is 6° higher. He then changes the minimum temperature forecast for the Forest City station by adding six degrees to it to make it fit the station on his own property. Now a forecast of 25° for the Forest City station does not cause cold chills to chase up and down his spine in the horror of contemplating some known disaster. He merely changes the forecast to 31° for his own station and derives a feeling of security that warms the cockels of his heart. If he is a Christian man the next morning he probably feels some compassion for his less fortunate neighbor who might have suffered instead of an all consuming ire that prompts him to pen for publication a letter condemning the Weather Bureau for alarming the countryside with frost warnings that did not come to pass. I mention this matter for no other reason than that we have had a certain amount of this sort of thing to contend with.

Occasionally we are asked why we do not locate our forecast stations in the warmer instead of the colder part of each section so that the outside world will not gain the impression that a certain district is colder than other districts. The answer to this is simple. If the forecast stations were chosen in the warm spots then we would be forced to issue "no danger" forecasts on many occasions when damaging frosts would be experienced on low ground. Such forecasts not only would be valueless but actually mislead some growers into the loss of their crops in case they were prepared to protect them. We find it necessary, therefore, to locate our forecast stations in the colder places where the minimum temperature forecasts will have the greatest value.

Some timid souls have been fearful lest the broadcasting of frost reports for Florida would prevent the tourist trade from prospering in the state. There is nothing to fear from this. When frost occurs in Florida the temperatures in the North are at such low levels that the tourists are glad to be here to read in the Florida papers about the terrible cold waves at home. Frost has not yet driven tourists from Florida and is not likely to do so now. What really discourages the tourist trade is to have the visitors come to Florida expecting nothing but mild weather and then find that adequate provision has not been made for their comfort during the occasional cold spells that do occur.

Naming of the expected minimum temperature for each station brings a definiteness to the frost forecasts that is entirely new to Florida. The old method of forecasting frosts in such vague and indefinite terms as light, heavy, killing, freezing temperatures, cold wave, and the conditional terms in forecasts such as probably, possibly, if, have been discarded, let us hope, forever. Obviously a killing frost for truck might be a temperature that actually would be beneficial to citrus. When the lowest temperature is named as a definite figure in the forecast there is no doubt as to the exact nature of the frost that is expected to occur at the forecast station.

As a price for these definite statements by the forecaster, however, a factor of safety sometimes is written into the forecasts so that the errors, if, any, are on the safe side. Most growers have expressed themselves as desiring to be overwarned rather than underwarned, and to have somehing definite to go by rather than some-

thing that leaves them wondering just what really was expected. These growers take the position that if there is any guessing to be done about the weather it is better that the forecaster take this responsibility. They are willing to tolerate the factor of safety in some of the forecasts when reasonable doubt arises, for the sake of the added security it gives them. From many years experience with growers on frost protection work the leaders of the Horticultural Protection Service subscribe one hundred per cent to this proposition. The forecaster continually is working to make his forecasts of the greatest value to the users of the service and trying to reduce the number of errors to the smallest possible amount. There have been but few complaints on the forecasts issued during the first year of operation, and these mostly from growers in warm locations who care little if their neighbors suffer, and from a small group who feel it is to their advantage to conceal the truth about temperature conditions from properties they are trying to sell.

Rigid official rules are used in the verification of all Weather Bureau forecasts. It is by these rules that the accuracy of the season's work in forecasting can be quickly judged. All the forecasts issued by the Lakeland office daily last winter have now been officially verified.

At each of the four forecast stations, Sarasota in Sarasota County; Brooksville in Hernando County; Mammoth in Polk County; and Forest City in Seminole County, covering the key situations in the four frost districts, the forecasting record has been determined by considering all forecasts issued during the operation of service, November 22, 1935 to April 1, 1936. During this interval 131 forecasts were issued. At the Sarasota station 123 of these, or 93% were without error; 96% were within 1° of being correct; 99% within 3°, and 100% within 4°. The greatest miss of the season was on February 1, 1936 when 30° was forecast for this station and a verifying temperature of 26° was experienced.

At the Brooksville station 88% of the forecasts were without error; 92% within 13 of being correct; 93% within 29; 97% within 3°; 99% within 4°, and 100% within 5°. The greatest miss of the season was on December 25, 1935 when a forecast of 31° was followed by a verifying temperature of 26°.

At the Mammoth station 88% of the forecasts were correct; 92%

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CITRUS FRUIT BUDS AND SOME FACTORS INFLUENCING THEIR DIFFERENTIATION

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flush of growth was made during the spring, summer or early fall. However, blossom buds have been observed to occur further back on the branches where the wood is much larger and older. This is especially true on trees that blossom very heavily following prolonged moderately dry seasons, which apparently are most favorable for stimulating blossom bud formation.

The "June bloom" or blossom buds which usually occur during the summer following a moderately dry period, are differentiated at the initiation of the June or summer flush of growth on trees, or parts of trees, that set few or no fruit during the spring. Buds collected in 1930 from spring flush of growth on grapefruit trees from which the fruit set during the spring had been removed, showed blossom bud differentiation May 31. In 1931, June blossom buds were not differentiated until about the middle of July. This evidently was due to the limited rainfall during the months of April, May and June, associated with a light set of fruit during the spring.

The first sign of fruit bud differentiation as seen under the microscope is the flattening of the top of the growing point, which is usually loosely covered by bud scales. The next stage is the development of the calyx (sepals), followed by the development of the corolla (petals), stamens and pistil. The stigma, located at the top of the pistil, is the last flower part to be formed. This order of development is the same for all flowers studied.

Fruit bud formation is undoubtedly influenced by such orchard practices as pruning, irrigation, cultivation and fertilization. Other factors that may have a rather marked influence on the number of blossom buds differentiated are ringing, shading and the kind of stock on which the trees are growing.

We do not have experimental data to show the exact influence of all of these factors on the number of blossom buds formed in citrus. However, in this study we are doing some work on ringing, shading and withholding moisture. This work is not yet complete, therefore the data cannot be taken as final.

The ringing experiments were started in the spring of 1930. At that time six branches, ranging from one to one-and-a-half inches in diameter, on each grapefruit, orange and satsuma trees, were ringed on March 25, by removing one-fourth inch section of bark completely surrounding the branch. Each wound was carefully wrapped with budding tape to prevent drying. Upon examining the wounds May 1, it was found that every ringed branch on grapefruit, orange and satsuma trees had healed perfectly, and the foilage, which had become yellow about two weeks after ringing, had returned to a healthy dark green color. Materials collected at weekly intervals from these branches showed no increase in the number of blossom buds differentiated due to ringing as compared with unringed portions of the various trees.

On May 3 other branches were ringed on grapefruit, orange and satsuma trees, the same as above, but precautions were taken to prevent the rapid filling-in and healing of the wounds. Buds were collected from these branches at weekly intervals throughout the season. The leaves soon became yellow in color, and all visible vegetative growth ceased. The leaves remained yellow throughout the growing season and many dropped during the late summer. The ringed branches did not make a "June flush" of growth as did the unringed portions of the various trees. Materials collected from the branches September 6, at the time when the buds were just swelling and starting growth, showed the first evidence of blossom bud differentiation, and on September 27 the ringed branches on all trees were in full bloom.

After it was learned that blossom bud differentiation definitely took place at the beginning of growth in the spring, other branches were ring-

ed. Two methods of ringing were used, viz. the removal of a strip of bark as described above and by simply ringing the branch with a sharp knife without the removal of any bark. The first ringing was done during the first week in October, and thereafter at intervals of about four weeks through December.

It was found by actual count that branches ringed by the removal of a strip of bark in October, November and December, produced 25.1 per cent, 24.9 per cent and 25.4 per cent more blossom buds respectively than were produced by comparable unringed branches used as checks. The other set of branches which were ringed at the same time as the above, but without the removal of the bark, produced 18.8 per cent, 20.7 per cent and 25.1 per cent more blossom buds respectively than did the check branches.

These figures seem to indicate that ringing by removal of the bark is just as effective in stimulating blossom bud formation when done in October as when done either in November or December. This perhaps is due to the longer lasting effects of the more severe form of ringing. Where the bark is not removed the wounding is not so severe and the effects are not so lasting. Thus a smaller number of blossom buds were produced on branches ringed in October than on branches ringed in either November or December. This conclusion is supported in part by the results obtained from ringing during March. Ringing at this time gave no increase in the number of blossom buds formed over unringed portions of the tree, even though a band of bark had been removed.

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A little salt in a glass of drinking water will provide an effective "pick-up" for the heat sufferer in hot weather.

Soil Conservation

Florida Farmers Cooperate in Soil Conservation Program

BY H. G. CAYTON
FLORIDA AGRICULTURAL EXTENSION SERVICE

The Soil Conservation Program is not yet well understood by many people. It differs from the former program of 1933 through 1935, which was a production control program for certain agricultual commdities. Production control required definite contracts with individual producers for the purpose of regulating production of the commodities affected and the individual producer was restricted in his operations to meet his contract requirements. While signing a contract was a purely voluntary procedure with the producer, there were additional control laws for cotton and tobacco and any producer who exceeded his production quota was taxed one-third to one-half the value of the excess production. These same control laws also afforded the farmer a type of crop insurance since if his production was less than his quota, he could sell the remainder of his quota at a fixed price.

This program was an emergency program and farm income was greatly improved by its operation. Also producers accepted the program and cooperated to a high degree, there being only a small minority who failed to cooperate.

The new Soil Conservation Program is a broad general program designed to conserve soils and improve farm income. The program is purely

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within 1° of being correct; 96% within 2°; 97% within 3°; 98% within 4°; 99% within 5° and 100% within 7°. At this station the greatest miss was on Jan. 21, 1936 when a forecast of 25° was followed by a verifying temperature of 32°.

At the Forest City station 91% of the forecasts were correct; 94% within 1° of being correct; 97% within 2°; 99% within 3°; and 100% within 4°. The greatest miss of the season was on January 24, 1936 when a forecast of 28° was followed by a verifying temperature of 32°.

These four stations have been selected to show a cross section of the forecasting record for last winter. These four stations are the key stations for each district and the most important on the forecast list. The forecasting record for the 36 other forecast stations are included in the statistical report now on file at County Agents offices for public examination. At these other stations cold nights only were considered in verifying and the percentage figures are somewhat lower than those recited here but on the same basis the forecast verifications are about the same.

As the Horticultural Protection work is entirely new in the State of Florida there is a great deal of pioneering work that must be done before the service can function to its maximum degree. Data must be accumulated and studied before the variation in temperature in different parts of the district can be determined and before the forecasting for the many stations can reach the desired degree of accuracy, which is, of course, 100% of all forecasts correct. It will take at least five years to collect enough data of this sort before the forecasting can be regarded as out of the experimental stage and at least ten years before detailed temperature survey maps can be prepared. Meanwhile, owing to strong demands for immediate service, the forecasting is being handled largely on the basis of experience gained in other sections of the country. There is need also for much experimental work to determine what can be done in the matter of frost protection in Florida. Experiments designed to determine the freezing points for the several varieties of fruits and vegetables produced in Florida must be planned and executed. The relative costs of grove protection with the different fuels available for grove heating in Florida also will form an extensive branch of research. For the immediate present the big job ahead is to accumulate information and experience locally, and to use the results of research as rapidly as they can be formulated, thus gradually improving the character of the service. We cannot offer a finished project at this time but the work is being planned to accomplish as much of the vital work as possible in the briefest time.

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a voluntary program and there are no contracts with individual producers. All farmers are eligible to participate in this program, the basis of participation, is in accordance with the type of crops being produced.

In this program Crop Land means all farm land which is tillable and from which at least one crop (other than wild hay) was harvested between January 1, 1930, and January 1, 1936, and includes land in orchards and vineyards not yet of bearing age.

In this program farm land is classified according to the crops and uses to which the land is devoted and we have three general classes of crops, as (1) Soil Depleting Crops, such as corn, cotton, tobacco, truck crops, sugar cane, small grains, peanuts harvested for market, etc.

(2) Soil Conserving Crops, such as velvet beans, peanuts when pastured, cowpeas, winter legumes, winter cover crops, such as rye, oats if pastured, or if cut and followed by a legume—permanent pastures and forest trees planted on crop land since January, 1934.

(3) Neutral Uses of Land, such as idle crop land, wood land and land in vineyards, tree fruits, small fruits or nut trees.

The 1936 objective of the program is to divert thirty million acres of crop land from soil depleting crops to soil conserving crops.

The soil depleting base acreage will be set up for every farm cooperating in this program.

In the operation of this program two types of payments will be made to cooperating producers.

Class I Payment will be made for the carrying out of soil building practices approved by the Secretary. The total amount of the Class II payment for any farm cannot exceed the sum obtained by multiplying the total number of acres on the farm devoted to soil conserving crops, times $1.00 per acre.

Under the above classification it is possible for a producer to secure both Class I and Class II payments on the same farm. A producer may, however, not care to divert acreage and so long as he did not expand beyond certain limits the depleting acreage on his farm it would be possible for him to carry out soil building practices and to qualify for Class II payments.

Truck farmers and citrus growers have the opportunity to qualify for payments under this program, while in the former programs they could not qualify. The Class II payment can be earned on nearly any citrus grove or truck farm in Florida.

The procedure to follow by any producer who wishes to participate in this program is to fill out a work sheet for his farm. The work sheet is a simple form on which is given the farm description, total acres of land, cultivated acres yields and history of the crops grown in 1935, etc. Filling out a work sheet is the only way to get the information about the farm in shape to determine what changes can be made to best fit into the soil conservation program. The filling out of a work sheet imposes no obligation upon a producer and should a producer who has filed a work sheet later decide not to cooperate in the program, no harm has been done. However, every producer who secures a payment under this program must have filed a work sheet within a given period. The point I wish to emphasis is that every producer should fill out a work sheet, otherwise some producers may find they cannot cooperate in the program because they failed to make out a work sheet within the prescribed time limit.

The County Agent and local commiteemen have work sheets and will assist any grower to get the data for his farm properly written up.

From Marion County north and west, the cut-off date for receiving

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work sheets expires today. South of Marion County work sheets may be filed for some days yet.

Producers who make out work sheets and who cooperate in the program will later fill out an application for a grant. This application will be the document upon which payment will be made.

The above is a very brief outline regarding the Soil Conservation Program, and many details have been omitted. The Southern Region, under this program, consists of South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Arkansas and Oklahoma. In this region and in Florida the response of farmers and their interest in the new program is fine. Farmers are not yet thoroughly informed on the new program, and the more they learn about it, the better they like it. Some of the comments and reactions coming to the Gainesville office may be summarized as follows:

(1) The new program is a safer program than the former control program.

(2) It allows the farmer more latitude in his farm operations.

(3) This is one program for the whole farm and not a separate program for each commodity.

(4) The rates of payment are as good as they were under the control program.

(5) While this is a Soil Conservation Program yet the diverting of acreage to soil conserving crops will exert some influence over production and thereby help farm prices.

(6) Such a program should have been placed in operation thirty years ago.

(7) Farmers will accept and benefit greatly under the Soil Conservation Program.

Our records based on reports from a number of counties indicate we will have a considerably larger number of Florida farmers participating in the Soil Conservation Program than under the former programs. Many farmers whose farms were not eligible under the former programs are now eligible.

Dr. Barnett has just outlined the need and value of growing summer legumes on Florida soils. Under the Soil Conservation Program, farmers can secure payment for doing the things which he has outlined as being good for the land.

In closing let me stress one point —some amendments to the present regulations are now under consideration in Washington. These amendments, if approved, will make the program more attractive to the citrus grower and truck farmer so let me urge the truck farmers and citus growers to fill out work sheets in order to be in position to take advantage of any amendments which are approved by the Secretary.

Citrus Fruit Buds And Some Factors Influencing Their Differentiation

(Concluded from last issue)

To determine the effects of withholding moisture on the number of blossom buds formed, twelve two-year-old trees each, of Pineapple orange and Duncan grapefrut, all budded on Poncirus trifoliata root-stock, were secured in February, 1929. The trees were set in one-half barrel tubs, made by sawing 52 gallon Coca-Cola barrels in two. The soil used in the tubs was a fairly good grade of potting soil, made up largely of approximately equal parts of leaf mold, muck and sand. The trees made an excellent growth and in the spring of 1931 the trees produced what we considered a good crop of blossoms. The entire crop of blossoms was removed from all trees at about the time the petals began to fall, thus avoiding the drain of developing fruit on the tree as far as possible.

On April 25 eight of the largest and most uniform trees of each, orange and grapefruit, were selected for the experiment. Each of these groups was further subdivided into two groups of four trees each. Four of the trees in each case were designated as checks. The tubs in which each of the the other trees were growing were covered with heavy wrapping paper, which after being placed in position over the tub was waxed thoroughly so as to make sure that no water, other than that applied, could reach the roots of the trees. These trees were allowed to wilt slightly during the night. The amount of water required varied according to weather conditions. In most cases the amount applied ranged from about one pint to one quart per tree per day. There seemed to be very little difference in the amount of water required by the two groups of trees.

The tubs of the check trees were left uncovered and trees were kept well watered. In no case were the check trees allowed to wilt or suffer for the lack of moisture.

On May 16, twenty-one days after covering the tubs, the covers were removed and the trees thoroughly watered. Six days later the trees showed growth activity, and on the ninth day the buds were far enough advanced that blossom buds could be seen without the aid of a magnifying glass.

On June 13 the shoots or branches on all trees which had made a flush of growth were counted. On the orange trees it was found that 287 branches had made growth. Of these 170, or 59.2 per cent, of the branches produced blossoms.

The grapefruit trees which were treated the same as the orange trees had 111 shoots or branches that made a flush growth. Seventeen, or 15.3 per cent of these branches, produced blossoms.

The check trees of both orange and grapefruit behaved quite differently from the trees under treatment. There were 170 branches on the orange trees that made a flush of growth, none of which produced blossoms. The check grapefruit trees had 109 branches that made a flush of growth and like the oranges none of the branches produced blossoms.

The blossoms and fruit formed on the trees under treatment were removed soon after the petals dropped and the trees were allowed to mature the growth before the next experiment was started.

In September the experiment was repeated on the the same trees. The covers were placed over the tubs September 6, in the same manner as before, and were allowed to remain for 23 days. The covers were removed September 29 and the shoots making growth were counted October 31.

It was found that 57 branches or shoots on the orange trees had made a flush of growth and of these 45, or 78.9 per cent had produced blossoms.

There were only 322 grapefruit branches that made growth, and of these 10 branches, or 45.4 per cent, bore blossoms.

The check trees of both the orange and grapefruit plots failed to make a visible growth of any kind.

It was found in other tests that trees growing in the open could not be forced into growth during November or December after the nights get cool, following the withholding of water for a period of three or even four weeks. Apparently something more than water is needed in order to start growth in trees at this season of the year.

These experiments have shown definitely that both ringing and restricting the moisture supply encourages fruit bud formation but neither is considered a satisfactory method of increasing the crop of fruit. The former method is injurious to trees or parts of trees so treated and the latter cannot be controlled in a region of heavy rainfall, such as prevails in Florida.

The question then arises, what can the grower do to increase the number of blossom buds formed, so as to avoid light crops or prevent the alternate bearing of his trees.

The answer to this question might involve many factors, especially since fertilizer and cultural practices vary widely from district to district, and give rise to endless controversy amongst growers.

In recent years attention has been directed to the carbohydrates and nitrogenous compounds in the tree; and it is now considered that the balance between these two components or, as it is usually termed, the carbohydrate-nitrogen ratio, largely decides the type of vegetative growth made, and the degree of fruitfulness of the tree.

It is considered that when the carbohydrates are relatively very high, and the nitrogen low, the plant tends to be stunted and weakly in growth and unfruitful. When the nitrogen is relatively high and the carbohydrates low, a very strong vegetative growth is produced, but in this case also the tree is unfruitful.

The fruitful condition is associated with moderate growth and an intermediate ratio of carbohydrate to nitrogen. The actual quantities of these substances present are not so important in deciding growth type as the balance between them. It is not suggested that the carbohydrate-nitrogen ratio is the sole factor of this type. The balance between the other elements in the plant probably will be found upon further investigation to be equally important.

Consideration of the carbohydrate-nitrogen ratio leads one to realize that the effects of such orchard practices as ringing, pruning, the application of nitrogenous fertilizers, and clean cultivation as compared with the growing of trees under a non-cultural program may be expected to vary in accordance with the

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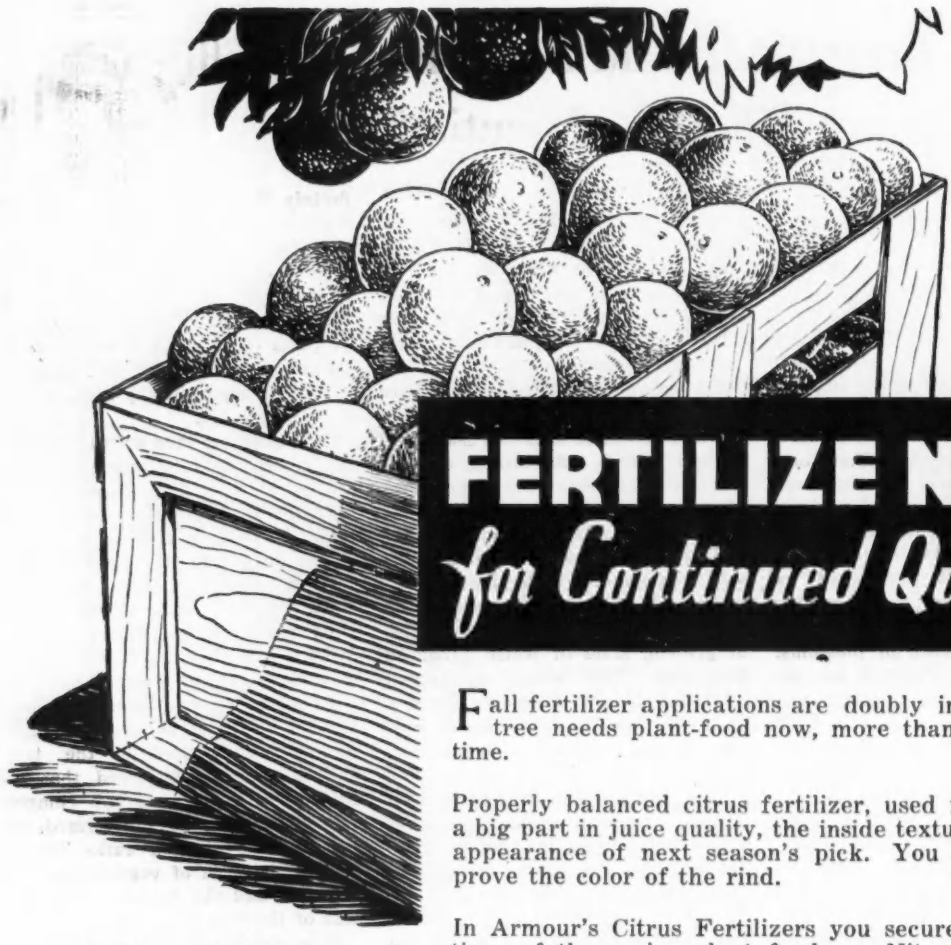

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